

Reproduction of the Cape Horned Lizard, *Phrynosoma coronatum* (Squamata: Phrynosomatidae) from Baja California Sur, Mexico

Stephen R. Goldberg

Whittier College, 13406 E. Philadelphia St. Whittier, CA 90608,
sgoldberg@whittier.edu

Species of *Phrynosoma* (formerly *P. coronatum*) range west of the Sierra Nevada from Shasta County, California, south through southern California and Baja California (Grismer 2002). Montanucci (2004) and Leaché et al. (2009) considered *Phrynosoma* from the southern tip of Baja California as *P. coronatum*. Goldberg (1983) reported on reproduction in *Phrynosoma blainvillii* (as *P. coronatum*) from southern California. To my knowledge, there is no information on reproduction of *P. coronatum* from the Cape Region of Baja California Sur, Mexico. The purpose of this note is to report the results of a histological examination of *P. coronatum* gonads from the Cape Region of Baja California Sur to ascertain whether geographic variation in reproduction exists between northern and southern species of *Phrynosoma* (formerly *P. coronatum*, *sensu* Montanucci 2004, Leaché et al. 2009).

A sample of fourteen *P. coronatum* consisting of seven adult males (mean SVL = 76.9 mm \pm 9.1 SD, range: 61–90 mm), five females (mean SVL = 79.2 mm \pm 14.0 SD, range: 67–103 mm), one presumed neonate (SVL = 27 mm) and one presumed young of the year (SVL = 36 mm) was examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles, California, U.S.A. (Appendix). *Phrynosoma coronatum* were collected 1964, 1967 and 1968.

For histological examination, the left testis was removed from males and the left ovary was removed from females. Enlarged follicles (> 5 mm length) were counted. Tissues were embedded in paraffin and cut into sections of 5 μ m. Slides were stained with Harris hematoxylin followed by eosin counterstain (Presnell and Schreiber 1997). Slides of testes were examined to determine the stage of the spermatogenic cycle. Slides of ovaries were examined for the presence of yolk deposition. An unpaired *t*-test was utilized to compare *P. coronatum* male and female mean body sizes (SVL) using InStat (vers. 3.0b, Graphpad Software, San Diego, CA). Histology slides were deposited in LACM.

There was no significant size difference (mean SVL) between males and females of *P. coronatum* (unpaired *t* test, $t = 0.35$, $df = 10$, $P = 0.73$). The only stage present in the testicular cycle was spermiogenesis (sperm formation) in which the lumina of the seminiferous tubules were lined by clusters of sperm and/or metamorphosing spermatids. This condition was noted in the following monthly samples: (July, $n = 1$; August, $n = 6$). The testes were previously removed leaving the epididymides in one August male (LACM 109380). Tubules of the epididymis were filled with sperm so it was assumed the missing seminiferous tubules were undergoing spermiogenesis. The smallest spermiogenic male (LACM 19904) measured 61 mm SVL and was from August.

Monthly stages in the ovarian cycle are in Table 1. Three stages were noted: (1) quiescent, no yolk deposition; (2) early yolk deposition, basophilic yolk granules in the ooplasm; (3) enlarged ovarian follicles > 5 mm. One female from July (LACM 101500)

Table 1. Monthly stages in the ovarian cycle of five *P. coronatum* from Baja California Sur, Mexico.

Month	<i>n</i>	Quiescent	Early yolk deposition	Enlarged follicles > 5 mm
July	2	0	1	1
August	2	1	1	0
October	1	1	0	0

contained 12 enlarged follicles (> 5 mm) that would have ovulated later in the summer. This is within the range of 7–16 clutch sizes reported by Goldberg (1983) for *P. blainvillii* (as *P. coronatum*) females from southern California. This was also the smallest reproductively active female (SVL = 71 mm). One female from August (LACM 19907) exhibited early yolk deposition which would have resulted in an egg clutch being produced during the coming autumn.

One presumably neonate (LACM 101504, SVL = 27 mm) was collected 17 July and one juvenile (LACM 19905, SVL = 36 mm) was collected 9 August both indicating *P. coronatum* commenced reproduction earlier in the year.

My data indicate a significantly longer reproductive cycle for *P. coronatum* from the Cape Region of Baja California Sur as compared to *P. blainvillii* in southern California (Goldberg 1983). In southern California *P. blainvillii* (formerly *P. coronatum*) is a “spring breeder” in which reproductive activity commences in March and ends by July (Goldberg 1983). In the Cape Region of Baja California Sur, reproduction of *P. coronatum* occurs through summer. Also, the appearance of a presumed neonate in July and a larger presumed young of the year in August suggest that *P. coronatum* commenced reproduction earlier in spring, perhaps concurrent with northern species of *Phrynosoma* (sensu Montanucci 2004, Leaché et al. 2009). Furthermore, winter activity has been reported for *P. coronatum* in the Cape Region (Vandenburgh 1895, Leviton and Banta (1964). In view of the extended reproductive season in the Cape Region, it appears females of *P. coronatum* may routinely produce two clutches per season, although this has yet to be observed. Goldberg (1983) indicated two clutches might be possible for some *P. blainvillii* (as *P. coronatum*) females from southern California. In contrast, Howard (1974) reported one clutch was produced by *Phrynosoma* from northern Baja California.

Acknowledgements

I thank Christine Thacker (LACM) for permission to examine *P. coronatum*.

Literature Cited

- Goldberg, S.R. 1983. Reproduction of the coast horned lizard, *Phrynosoma coronatum*, in southern California. *Southwestern Naturalist*, 28:478–479.
- Grismer, L.L. 2002. *Amphibians and Reptiles of Baja California including its Pacific Islands and the islands in the Sea of Cortés*. University of California Press, Berkeley. xiii + 399 pp.
- Howard, W.R. 1974. Comparative reproductive ecology of horned lizards (Genus *Phrynosoma*) in southwestern United States and northern Mexico. *Journal of the Arizona Academy of Science*, 9: 108–116.
- Leaché, A.D., M.S. Koo, C.L. Spencer, T.J. Papenfuss, R.N. Fisher, and J.A. McGuire. 2009. Quantifying ecological, morphological, and genetic variation to delimit species in the coast horned lizard species complex (*Phrynosoma*). *Proceedings of the National Academy of Sciences*, 106:12418–12423.
- Leviton, A.E. and B.H. Banta. 1964. Midwinter reconnaissance of the herpetofauna of the Cape Region of Baja California, Mexico. *Proceedings of the California Academy of Science*, 4th series, 330:127–156.

- Montanucci, R.R. 2004. Geographic variation in *Phrynosoma coronatum* (Lacertilia, Phrynosomatidae): further evidence for a peninsular archipelago. *Herpetologica*, 60:117–139.
- Presnell, J.K. and M.P. Schreibman. 1997. *Humason's Animal Tissue Techniques*. The Johns Hopkins University Press, Baltimore. 572 pp.
- Vanderburgh, J. 1895. Review of the herpetology of Lower California. *Proceedings of the California Academy of Science*, 2:77–163.

Appendix

Phrynosoma coronatum from the Cape Region of Baja California Sur examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles, California U.S.A. (LACM 19903, 15 km E San Bartolo), (LACM 19904, 19905, 19906, vic. Santiago), (LACM 19907, 38 km NW La Paz), (LACM 101500, 101502, 101503, 101504, 101506, 109378, 109379, 109380, 109381, La Paz).